Booster Magnet Measurements at E4R with the "Mole" Rotating Coil

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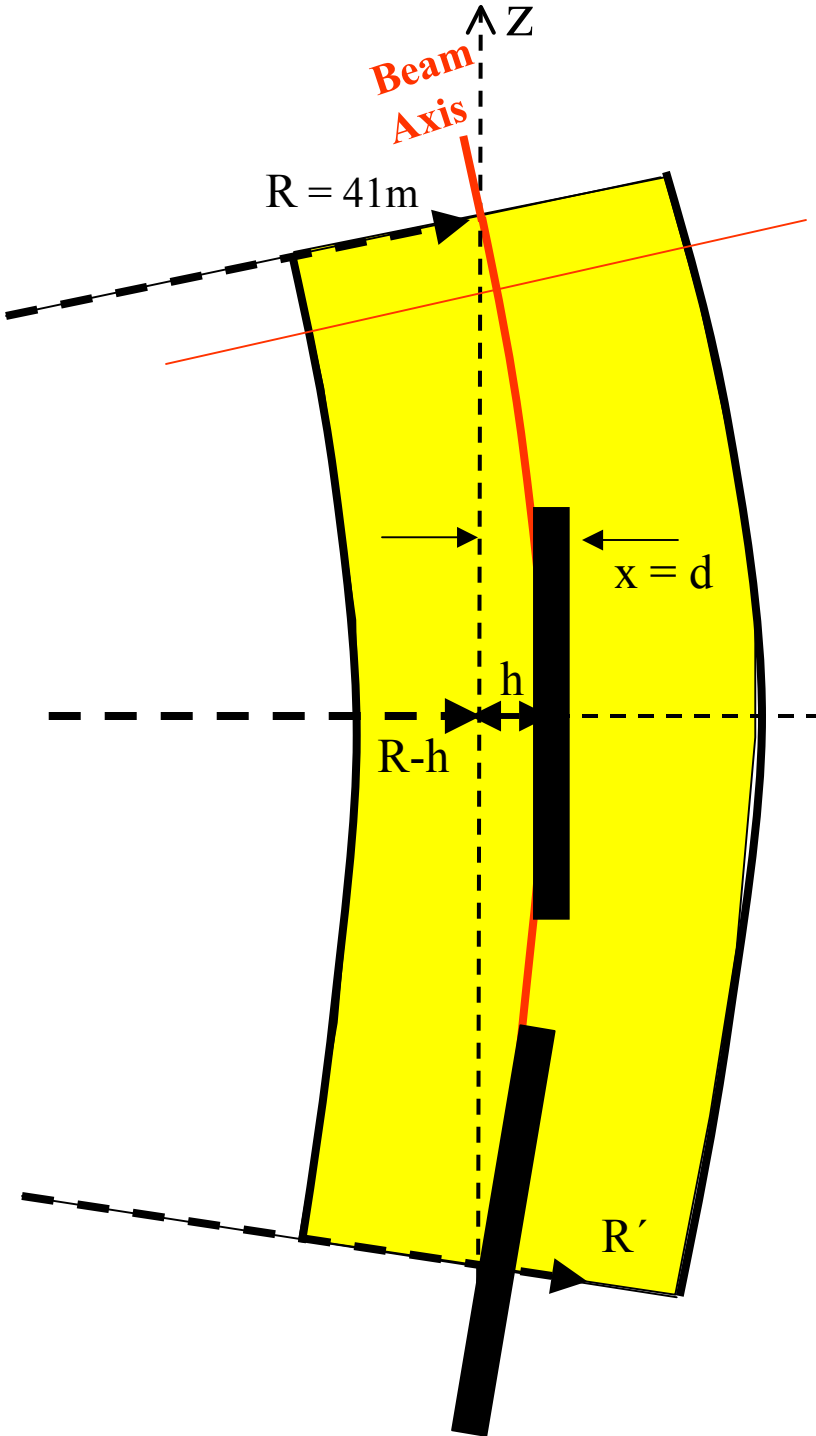
Mole measurement system

- BNL built for SSC
- 1m long, 1” diameter rotating coil within brass tube
- Self-contained electric motor drive, encoder
- Motor able to work in fields up to 0.05T (were able to exceed this by 25%)
- tangential with 2 dipole bucking windings (quad buck windings available but not used)
- 3.5s rotation period
- Induced voltage and current read out by HP3458 DVM’s
- Fixtures to allow mole to measure 5 positions in x (separated by 20mm) across aperture (note only 2 fixtures used for 50A data, 3 for 110A data)

Field Measurements

- Magnet D10 (SSW measurements were on F47)
- Measurements with DC current 50A, 110A
- Measurements at magnet center (body) and with mole center approximately at body/end transition (moel 50% in body and extending out LE)
- Sagitta correction for measuring with straight probe in Booster magnet is similar to ‘feed-down’ effects of 1mm (not very significant except for dipole magnitude).

Coordinate system



Mole is tangent to beam axis at its center

X position of mole in coordinate frame of Beam Axis is given by:

$$s(x,z) = R' - R$$

$$s(x,z) = \frac{R\left(1-\cos\left(z/R\right)\right)+(d-h)}{\cos\left(z/R\right)}$$

$$R' = \frac{R-h+d}{\cos(z/R)}$$

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Summary

- Good resolution DC measurements at 50A, 110A were obtained using the mole, scanning across the aperture.
- Body field measurements are roughly consistent with previous gradient probe measurements done by Peters.
- End field measurements show a large sextupole that substantially changes field shape though probe half in the body.